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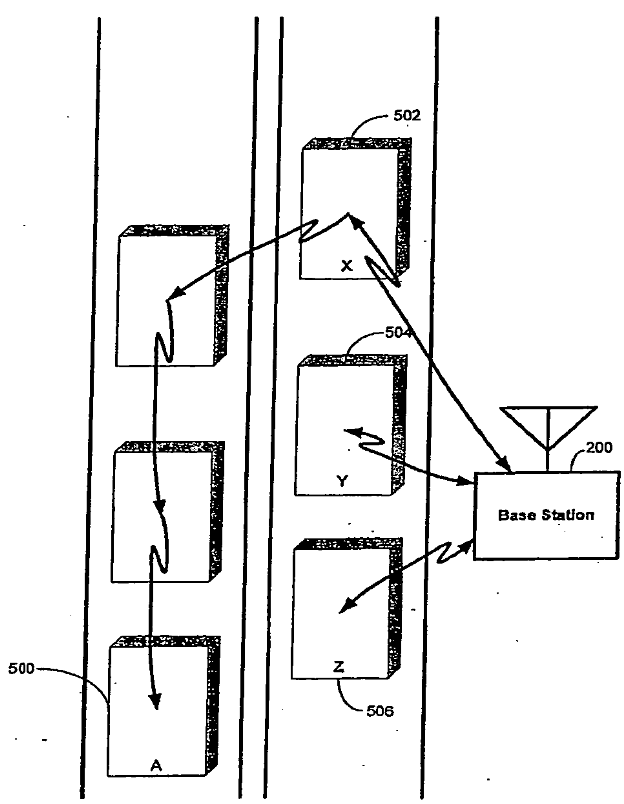
(54) Title: WIRELESS INTERNET SYSTEM FOR THE MOBILE ENVIRONMENT



(57) Abstract: A method to provide a wireless Internet system for the mobile environment by utilizing small coverage area mobile transceivers (500, 502, 504, 506) to pass data along a "virtual data pipe" to low power base stations (200) with ouside network connections. "Mobiles" (500, 502, 506) form the virtual data pipe allowing users a constant and maximized data rate. Low power base stations (200) will serve as "data depots" to transfer data to outside networks. All mobile transceivers (500, 502, 504, 506) and base stations (200) will be associated with unique addresses and will actively track surrounding addresses as the network changes in configuration. The data will be packetized with a mobile's address. The base stations (200) will keep a log of the last two known locations of each mobile (500, 502, 504, 506) to establish the direction of mobiles (500, 502, 504, 506) within the network. When a mobile (500, 502, 504, 506) passes a base station (200), it will deliver data bound for an outside network. The base station (200) will dump data bound for a destination mobile (500, 502, 504, 506) to the passing mobile (500, 502, 504, 506).

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WIRELESS INTERNET SYSTEM FOR THE MOBILE ENVIRONMENT

FIELD OF INVENTION

This invention relates generally to wireless communication networks that use packetized data transmission methods and, more specifically, to mobile Internet access. This invention also relates to methods to increase the overall data rate of a wireless communication network.

BACKGROUND OF THE INVENTION

Wireless Internet access is fundamental to the task of creating an ubiquitous computing infrastructure since modern lifestyles require significant mobility for business and for pleasure. Recently, the explosive growth of mobile communications has been facilitated by cellular and PCS telephones, text messaging pagers and two-way radio devices. A logical extension of this demand for mobile communications is the demand for mobile access to public and private computer networks, particularly the Internet. Therefore, efforts are being made to bring Internet access to the mobile environment. Various cellular and PCS networks offer access to certain websites for mobile subscribers. Popular informational sites have been adapted for such services, often by truncating or

streamlining data to accommodate cellular data transmission rates. A key element for being able to offer full mobile Internet services is to have a sufficient data rate for uplink and downlink communications. However, the data demands of Internet traffic make the full range of Internet capabilities difficult to achieve with cellular infrastructure.

Currently, the only system standard poised for wireless Internet capability is cellular. Satellite technology usually favors a large coverage area providing less than adequate data rate per user, making satellites less than ideal for wireless Internet. While current solutions make wireless Internet service possible, more can be done to establish efficient and more robust networks to handle more sophisticated services. All in all, there are few alternatives to cellular technology for wireless Internet access.

Aside from cellular networks, various methods have been devised to allow mobile access to other data communication networks. A packet switched multi-mode mobile communication network and mobile devices for use therewith have been devised for data communication network access. Mobile equipment and a base station packet switch are coupled to data terminal equipment to generate packetized data messages. The mobile and base station equipment each contain an intelligent switching node for selecting radio frequency transmission paths based on packet and transmission path information. An example of the method is described in U.S. Pat. No. 5,953,319 to Dutta et al. Although this invention provides a means of efficient routing for mobile data communications, it does not address increasing the data rate of the overall network.

A method has been devised for establishing data communication links between moving motor vehicles. This invention

communicates motion information to other nearby vehicles to establish a platoon control system for intelligent highway systems. An example of the method is described in U.S. Pat. No. 6,032,097 to Iihoshi et al. This method demonstrates that moving vehicles can exchange data although the scope is limited to vehicle motion data. It does not address data communication between the motor vehicles and an outside data network.

A method has also been devised to establish a vehicle communication and remote control system. This method involves a location identifying sensor coupled to a processor for supplying vehicle location data to outside networks. The processor is adaptable to establish two-way communications for location-specific data, emergency requests and other roadside assistance functions. An example of this method is described in U.S. Pat. No. 6,028,537 to Suman et al. A drawback of this method is that the scope is limited to closed communication networks. The method does not contemplate the requirements for communications between mobile and public data networks such as the Internet.

There is a need in the art for an alternative to cellular technology for wireless Internet access and also for a means to increase the data rate of wireless Internet access over current methods.

SUMMARY OF THE INVENTION

The present invention overcomes the above-described problems in the prior art by providing a method for implementing a wireless Internet system for the mobile environment. The present invention overcomes the problems of the prior art by providing a network that utilizes "mobiles", defined as mobile carriers such as

motor vehicles (including cars, trucks, buses, trains, or motorcycles) or walking individuals, equipped with data transceivers for communicating with other mobiles and the Internet or other outside networks. The invention is useful for such purposes as tracking stolen vehicles, providing navigational assistance, monitoring delivery truck routes, establishing vehicle to vehicle communications and broadcasting emergency vehicle warnings or real time traffic information. The invention is also useful for providing a lower power alternative to mobile telephone systems. In addition, the invention can be adapted for military uses such as tracking vehicles in a convoy or distributing commands and feedback throughout a mobile unit.

Generally described, the present invention utilizes the concentrated coverage area around transceiver-equipped mobiles in order to pass data from mobile to mobile, forming a dynamically programmed airborne path to a low power base station, or a "virtual data pipe", to access the Internet or another outside network. Several low power radio communication protocols are suitable for implementing the present invention and such protocols are well known in the art by one of ordinary skill. When a data link to an outside network is requested, the invention will calculate a virtual data pipe to the nearest base station. The low power base stations act as "data depots" for the data to be transferred to the Internet or other outside network. This method allows for increased network data rates and a more efficient utilization of transmission capacity and power. For incoming data, the base station will "drop off" data received from an outside network to the first mobile that passes by, making large base station coverage areas unnecessary. The data will then ricochet from mobile to mobile along a calculated virtual data pipe until it

reaches the mobile matching the destination address. An acknowledge signal will be sent back to the base station or the data will time expire within the virtual data pipe.

One aspect of the present invention includes a method for maximizing bandwidth per user per area for a mobile environment.

Another aspect of the present invention includes a method for associating all mobiles and base stations with a unique address for plotting transmission routes.

Yet another aspect of the present invention includes a method for all mobile transceivers and base stations to actively track each other using a tracking algorithm. Each mobile transceiver reports location information to the nearest base station. Location information is input into processing units coupled to the mobile transceivers for more efficient data routing.

In one embodiment of the present invention, a base station will keep a log of the last two known locations of each mobile transceiver within its coverage area. The two location positions for each mobile transceiver will be used to establish the direction any mobile transceiver is heading within the network.

In another embodiment of the present invention, the base station will estimate the location of a destination mobile transceiver using directional information and a log of the last two known locations of the destination mobile transceiver.

In another embodiment of the present invention, the base station will obtain the location of a destination mobile transceiver utilizing a global positioning system transceiver.

In another embodiment of the present invention, the mobile transceivers will utilize the IEEE 802.11 communications protocol to communicate with other mobile transceivers and base stations.

In another embodiment of the present invention, the mobile transceivers will utilize the Bluetooth communications protocol to communicate with other mobile transceivers and base stations.

In another embodiment of the present invention, the mobile transceivers will utilize wireless local area networks (wireless LAN) to communicate with other mobile transceivers and base stations.

In another embodiment of the present invention, the mobile transceivers will utilize infrared transceivers to communicate with other mobile transceivers and base stations.

In another embodiment of the present invention, a mobile transceiver will utilize a vehicle's power source to power on essential components in order to receive incoming data.

In yet another embodiment of the present invention, a mobile transceiver will be able to hold data for transmission until a new virtual data pipe is established.

Objects, features and advantages of the present invention will become apparent upon reading the following detailed description of the preferred embodiments of the invention, when taken in conjunction with the accompanying drawings and appended claims.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a system diagram that illustrates an exemplary environment suitable for implementing various embodiments of the present invention.

Fig. 2 is a system diagram that illustrates a high-level exemplary environment suitable for implementing various embodiments of the present invention.

Fig. 3 is a flow chart illustrating the steps of an exemplary embodiment of the programming aspects of the present invention.

Fig. 4 is a flow chart illustrating the steps of the operation of an exemplary embodiment of the present invention.

Fig. 5 is a system diagram that illustrates another high-level exemplary environment suitable for implementing various embodiments of the present invention.

Fig. 6 is a flow chart illustrating the steps of the operation of an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

Referring now in detail to the drawings in which like numerals refer to like parts throughout the several views, Fig. 1 is a system diagram that illustrates an exemplary environment suitable for implementing various embodiments of the present invention. Fig. 1 and the following discussion provide a general overview of a platform onto which the invention may be integrated or implemented. Although in the context of the exemplary environment the invention will be described as consisting of instructions within a software program being executed by a processing unit, those skilled in the art

will understand that portions of the invention, or the entire invention itself may also be implemented by using hardware components, state machines, or a combination of any of these techniques. In addition, a software program implementing an embodiment of the invention may run as a stand-alone program or as a software module, routine, or function call, operating in conjunction with an operating system, another program, system call, interrupt routine, library routine, or the like. The term "program module" will be used to refer to software programs, routines, functions, macros, data, data structures, or any set of machine readable instructions or object code, or software instructions that can be compiled into such, and executed by a processing unit. The term "processing unit" will be used to refer to microcontrollers, microprocessors, reduced instruction set computers (RISC), digital signal processing (DSP) chips, application specific integrated circuits (ASIC), field programmable gate arrays (FPGA) or any combination of such components.

Those skilled in the art will appreciate that the system illustrated in Fig. 1 may take on many forms and may be directed towards performing a variety of functions. Examples of such forms and functions include cellular telephones, radio telephones, portable telephones, two-way pagers, personal computers, hand-held devices such as personal data assistants and calculators, consumer electronics, note-book computers, lap-top computers, and a variety of other applications, each of which may serve as an exemplary environment for embodiments of the present invention.

The exemplary system illustrated in Fig. 1 includes a computing device, which in the context of the present invention will be in the form of or include a mobile transceiver **110**, that is made up

of various components including, but not limited to a processing unit **112**, non-volatile memory **114**, volatile memory **116**, and a system bus **118** that couples the non-volatile memory **114** and volatile memory **116** to the processing unit **112**. The non-volatile memory **114** may include a variety of memory types including, but not limited to, read only memory (ROM), electronically erasable read only memory (EEROM), electronically erasable and programmable read only memory (EEPROM), electronically programmable read only memory (EPROM), electronically alterable read only memory (EAROM), FLASH memory, bubble memory, and battery backed random access memory (RAM). The non-volatile memory **114** provides storage for power on and reset routines (bootstrap routines) that are invoked upon applying power or resetting the computing device **110**. In some configurations the non-volatile memory **114** provides the basic input/output system (BIOS) routines that are utilized to perform the transfer of information between elements within the various components of the computing device **110**.

The volatile memory **116** may include, but is not limited to, a variety of memory types and devices including, but not limited to, random access memory (RAM), dynamic random access memory (DRAM), FLASH memory, EEPROM, bubble memory, registers, or the like. The volatile memory **116** provides temporary storage for routines, modules, functions, macros, data, etc. that are being or may be executed by, or are being accessed or modified by the processing unit **112**. In general, the distinction between non-volatile memory **114** and volatile memory **116** is that when power is removed from the computing device **110** and then reapplied, the contents of the non-

volatile memory **114** remain intact, whereas the contents of the volatile memory **116** are lost, corrupted, or erased.

The computing device **110** may access one or more external display devices **130** such as a CRT monitor, LCD panel, LED panel, electro-luminescent panel, or other display device, for the purpose of providing information or computing results to a user. In some embodiments, the external display device **130** may actually be incorporated into the product itself. The processing unit **112** interfaces to each display device **130** through a video interface **120** coupled to the processing unit **110** over the system bus **118**.

The computing device **110** may send output information, in addition to the display **130**, to one or more output devices **132** such as a speaker, modem, printer, plotter, facsimile machine, RF or infrared transmitter, computer or any other of a variety of devices that can be controlled by the computing device **110**. The processing unit **112** interfaces to each output device **132** through an output interface **122** coupled to the processing unit **112** over the system bus **118**. The output interface may include one or more of a variety of interfaces, including but not limited to, an RS-232 serial port interface or other serial port interface, a parallel port interface, a universal serial bus (USB), FireWire (IEEE 1394), an optical interface such as infrared or IrDA, an RF or wireless interface such as Bluetooth, or other interface.

The computing device **110** may receive input or commands from one or more input devices **134** such as a keyboard, pointing device, mouse, modem, RF or infrared receiver, microphone, joystick, track ball, light pen, game pad, scanner, camera, computer or the like. The processing unit **112** interfaces to each input device **134**

through an input interface **124** coupled to the processing unit **112** over the system bus **118**. The input interface may include one or more of a variety of interfaces, including but not limited to, an RS-232 serial port interface or other serial port interface, a parallel port interface, a universal serial bus (USB), FireWire (IEEE 1394), an optical interface such as infrared or IrDA, an RF or wireless interface such as Bluetooth, or other interface.

It will be appreciated that program modules implementing various embodiments of the present invention may be may be stored in the non-volatile memory **114**, the volatile memory **116**, or in a remote memory storage device accessible through the output interface **122** and the input interface **124**. The program modules may include an operating system, application programs, other program modules, and program data. The processing unit **112** may access various portions of the program modules in response to the various instructions contained therein, as well as under the direction of events occurring or being received over the input interface **124**.

The computing device **110** may transmit signals to, or receive signals from, one or more communications systems **136** such as a cellular network, RF network, computer network, cable network, optical network or the like. The processing unit **112** interfaces to each communications system **136** through a transmitter **126** and a receiver **128**, both coupled to the processing unit **112** over the system bus **118**. The transmitter **126** and the receiver **128** may include one or more of a variety of transmission techniques such as a radio frequency interface (AM, FM, PSK, QPSK, TDMA, CDMA, FHSS,

Bluetooth or other technique) or an optical interface such as infrared or IrDA.

Fig. 2 is a system diagram that illustrates a high-level exemplary environment suitable for implementing various embodiments of the present invention. Those skilled in the art should note that, in addition to implementing this invention utilizing motor vehicles as described below, any mobile object or individual can be utilized to implement this invention with equal effectiveness. In this best mode implementation, a user in vehicle A **202** wanting to send a data request to a destination within the Internet (or other outside data network) will use vehicle A's **202** mobile transceiver to locate other "nodes", defined as mobile transceivers **110** or base stations **200**, within the coverage area. The mobile transceiver **110**, will utilize a path determination algorithm, such as a Viterbi algorithm, to establish a virtual data pipe to a destination node. When vehicle A's **202** mobile transceiver locates a node along the established path such as vehicle B **204** or a base station **200**, the data request will be transmitted to such mobile or base station **200**. Mobile transceivers **110** will be able to temporarily hold data requests until other nodes useful for forming a virtual data path are within range. Those skilled in the art will appreciate that the transmitter **126** can utilize any number of low power, short range transmission protocols. For example, a transmitter utilizing the IEEE 802.11 protocol will have a transmission range of several hundred meters. A Bluetooth protocol transmitter will have a range of only a few meters. The choice of transmission protocols can vary depending on network data rate goals and the proliferation of network enabled mobiles. If the transmission is made between mobile transceivers **110**, the retransmission of the

data request will continue along a dynamically constructed path. In this example, the data request will be transmitted along a virtual data pipe from vehicle A **202** to vehicle B **204** to vehicle C **206** to vehicle D **208**. Vehicle D **208** will "hand off" the data request when it comes within range of a base station **200**.

Fig. 3 is a flow chart illustrating the steps of an exemplary embodiment of the programming aspects of the present invention. A program module within the mobile transceiver **110** will be utilized to implement data requests **300** by a user. Data requests **300** will come from any number of interface devices suitable for vehicle drivers, passengers, riders, pedestrians, etc... Suitable devices include liquid crystal touch screen displays, voice recognition software, voice prompting software, laptop USB or FireWire compatible devices or Head Up Displays (HUD).

The mobile transceiver **110** will report to each base station **200** it passes by and will determine if it is within range and if it is heading towards or moving away from a base station **200**. The mobile transceiver **110** will also be operative to page all other mobile transceivers within range of its transmitter **126**. A virtual data pipe will be established by the program module **304** based on the location information from other mobile transceivers **110** and the location of the nearest base station **200**. A data request **300** will have to be reentered if no mobile transceiver location information is available **306**. (This can be performed by low level software, totally transparent to the user.) The source mobile transceiver **110** will transmit a data request to the nearest mobile transceiver **110** or base station **200** along the established route. The source mobile transceiver **110** will use periodic verification methods like timeout

algorithms or acknowledge signaling to ensure the transmission is completed **310**. The mobile transceiver **110** will continue to transmit **308** until the transmission is received **312** by a base station. A checksum or other verification method can be used to determine whether the complete transmission was received. The data request **302** would have to be repeated if a successful transmission cannot be verified. The data retransmission can be executed by the mobile transceiver **110** so that it is transparent to the user.

Fig. 4 is a flow chart illustrating the steps of the operation of an exemplary embodiment of the present invention. This flow example illustrates the process when a mobile transceiver **110** has received data and the established virtual data pipe to a base station has changed. The mobile transceiver **110** can utilize any number of scanning methods **400** to search for other mobile transceivers within range and to obtain location and, optimally, directional information. If a virtual data pipe to a base station has changed **402**, the mobile transceiver will have to reobtain location information from other mobile transceivers within range. If a path to a base station **200** can be established (utilizing a path determination algorithm), the mobile transceiver **110** will be operative to transmit the data **404** or temporarily hold the data until an appropriate hand-off node is within range. The mobile transceiver **110** will use a verification procedure to ensure the reception of the data **406**. If the data is not completely received by the base station **200**, or if the time for reception has elapsed, the mobile transceiver **110** must establish a new virtual data pipe by reobtaning the positions of other mobile transceivers **110** within range **400**. When the mobile transceiver **110** receives verification from the base station **200**, the transmission is complete.

Fig. 5 is a system diagram that illustrates another high-level exemplary environment suitable for implementing various embodiments of the present invention. This example demonstrates the operation of a base station **200** and specifically shows the method by which data is transferred between mobile transceivers **110** and an outside network via a low-power base station **200**. As mobiles equipped with mobile transceivers **110** pass a base station **200**, they "dump" data requests bound for the Internet. In return, the base station **200** downloads data it has received from the Internet to mobile transceiver **110** equipped mobiles as they pass by. In the illustrated example where the mobiles involved happen to be vehicles, the first vehicle X **502** to pass the base station **200** drops off data requests. The base station **200**, containing data addressed to vehicle A **500**, downloads that data to vehicle X **502**. The data will be retransmitted via mobile transceiver equipped mobiles until it reaches its destination address by following a predetermined virtual data pipe as described below. The next vehicle to pass, vehicle Y **504** will upload outbound data and receive data, if any, intended for any mobile transceiver equipped mobile in the vicinity. The process of exchange is repeated for vehicle Z **506**.

Fig. 6 is a flow chart illustrating the steps of the operation of an exemplary embodiment of the present invention. This flow example illustrates the method for base station **200** to mobile transceiver **110** communications. The base station **200** will determine the location of the destination mobile transceiver **110** by paging all the mobile transceivers in the surrounding area **600**. A tracking algorithm will utilize the location information to provide the instantaneous location of the destination mobile transceiver **110**.

Alternatively, the base station **200** could locate the destination mobile transceiver **110** using a global positioning system transceiver. If the base station **200** does not find the destination mobile transceiver **110** in the surrounding area **602**, it will page neighboring base stations with instructions to search for the destination mobile transceiver **610.** The base stations can communicate between each other using fiber optic cable, cellular, satellite or a variety of other methods well known by one in the art. If the destination mobile transceiver **110** is not found **612**, the base station **200** will increase the boundary of the base station scan to include base stations covering a wider area **614.** This paging and scanning will continue for wider and wider areas until the destination mobile transceiver **110** is located. When the destination mobile transceiver **110** is found, either during scans by the original base station **602**, or during scans conducted by other base stations **612**, a virtual data pipe can be established **604** by utilizing a path determination algorithm as previously described. The appropriate base station will transmit data to the destination mobile transceiver **110** along the established route **606**. The base station **200** will repeat the paging of mobile transceivers in the surrounding area **600** if a successful transmission cannot be verified **608**. If the destination mobile transceiver **110** is turned off, it could be configured to use a vehicle power supply (e.g., a battery) or other connected power source to temporarily power up in order to receive the data.

While this invention has been described in detail with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the scope of the invention as defined in the appended claims.

CLAIMS

What is claimed is:

1. A mobile transceiver operative to utilize a plurality of nodes, each node consisting of a mobile transceiver or a base station, to communicate within a network and with at least one outside network, the mobile transceiver comprising:

means to transmit packetized data to the next node of a transmission path if the destination of the packetized data is not the mobile transceiver; and

means to receive packetized data from a plurality of nodes.

2. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to transmit location information data to a base station.

3. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to make a short range transmission over an airborne transmission path.

4. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to transmit over an airborne transmission path using IEEE 802.11.

5. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to transmit over an airborne transmission path using a wireless LAN.

6. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to transmit over an airborne transmission path using an infrared transceiver.

7. The mobile transceiver of claim 1, wherein the means for transmitting data is operative to transmit over an airborne transmission path using Bluetooth.

8. The mobile transceiver of claim 1, wherein such mobile transceiver is associated with a mobile.

9. The mobile transceiver of claim 1, wherein such mobile transceiver is operative to temporarily store transmission data.

10. A mobile transceiver operative to utilize a plurality of nodes, each node consisting of a mobile transceiver or a base station, to communicate with at least one outside network, the mobile transceiver comprising:

means to transmit packetized data to the next node of a transmission path if the destination of the packetized data is not the mobile transceiver; and

means to receive packetized data from a plurality of nodes.

11. A mobile transceiver operative to utilize a plurality of nodes, each node consisting of a mobile transceiver or a base station, to communicate within a network, the mobile transceiver comprising:

means to transmit packetized data to the next node of a transmission path if the destination of the packetized data is not the mobile transceiver; and

means to receive packetized data from a plurality of nodes.

12. A base station operative to communicate between a plurality of nodes, each node consisting of a mobile transceiver or a base station, and at least one outside network, the base station comprising:

a path determination algorithm for defining a transmission path at any particular point in time for a particular transmission;

a tracking algorithm for utilizing location information data from a mobile transceiver to provide the instantaneous location of such mobile transceiver;

means to transmit packetized data to the next node of a transmission path if the destination of the packetized data is not the base station;

means to transmit packetized data to an outside network;

means to receive packetized data from a plurality of nodes; and

means to receive packetized data from an outside network.

13. The base station of claim 12, wherein such base station is located in close proximity to a virtual data pipe whereby the transmission power of the base station can be reduced.

14. The base station of claim 12, wherein the transmission path to a mobile transceiver is determined by location information data.

15. The base station of claim 12, wherein the location information data for a mobile transceiver is determined by a global positioning system.

16. The base station of claim 12, wherein the means for receiving packetized data includes the means to receive location information data for determining the instantaneous location of a mobile transceiver.

17. The base station of claim 12, wherein the means for

transmitting data is operative to send transmission verification to a mobile transceiver.

18. The base station of claim 12, wherein the means for transmitting data is operative to transmit over short ranges.

19. The base station of claim 12, wherein the means for transmitting data is operative to transmit over long ranges.

20. The base station of claim 12, wherein the means for transmitting data is operative to page a mobile transceiver.

21. The base station of claim 12, wherein the means for transmitting data is operative to broadcast to all mobile transceivers within a network.

22. A mobile communications system operative to utilize a plurality of nodes, each node consisting of a mobile transceiver or a base station, to communicate with at least one outside network, the mobile communications system consisting of:

a transmission path consisting of wireless links between one or more nodes;

a path determination algorithm for defining a transmission path at any particular point in time for any transmission;

a means to transmit packetized data between nodes along the transmission path if the destination address of the packetized data does not match the address of the current node;

a means to process packetized data if the destination address of the packetized data does match the address of the current node;

at least one mobile transceiver for sending and receiving airborne signals including location data, information requests, and repeating airborne signals from other mobile transceivers; and

at least one base station for sending and receiving airborne signals between a plurality of mobile transceivers and at least one outside network.

23. The mobile communications system of claim 22, wherein the path determination algorithm is operable to poll each mobile transceiver in its vicinity to obtain location information.

24. The mobile communications system of claim 22, wherein the path determination algorithm is operable to use direction finding from a base station to ping mobile transceivers to obtain location information.

25. The mobile communications system of claim 22, wherein the path determination algorithm is operable to identify, at transmission time, a path from any point along the transmission path to the destination node.

26. The mobile communications system of claim 22, wherein the path determination algorithm is operable, at transmission time, to identify a path to the next node based on the location of the destination node.

27. The mobile communications system of claim 22, wherein the transmission data can be temporarily stored until a transmission path is established.

28. The mobile communications system of claim 22, wherein the base station is operable to broadcast packetized data to all mobile transceivers within a network.

29. A method for implementing a mobile communications system of transmission paths consisting of wireless links between a plurality of nodes, each node consisting of a mobile transceiver or a base station, the method comprising the steps of:

defining a transmission path at any particular point in time for a particular transmission;

passing packetized data to the next node on the transmission path if the destination of the packetized data is not the current node; and

acting on the packetized data if the destination of the packetized data is the current node.

broadcasting packetized data to all mobile transceivers within a network.

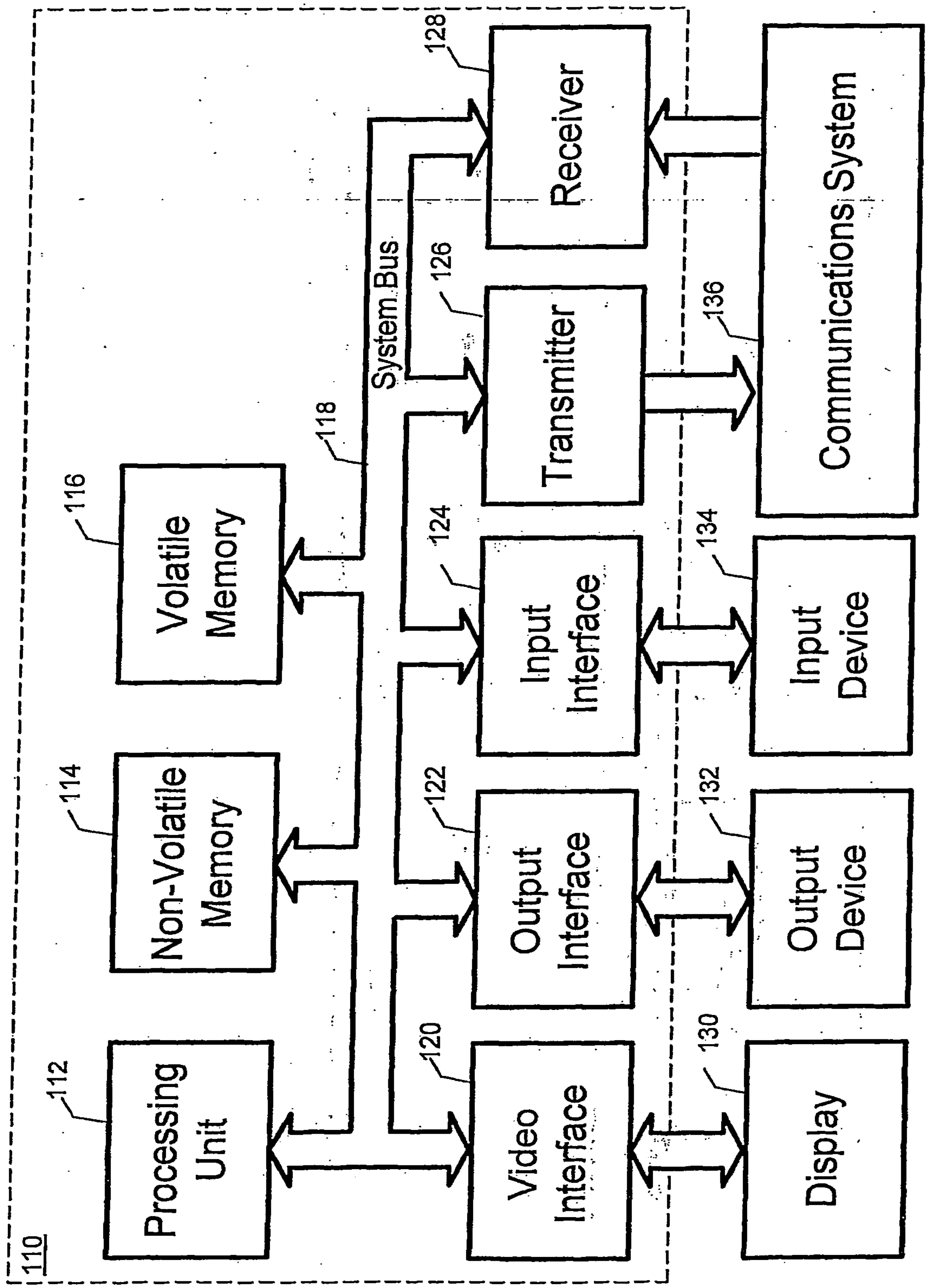
110
Processing Unit
112
Non-Volatile Memory
114
Volatile Memory
116
System Bus
118
Video Interface
120
Output Interface
122
Input Interface
124
Transmitter
126
Receiver
128
Display
130
Output Device
132
Input Device
134
Communications System
136

Fig. 1

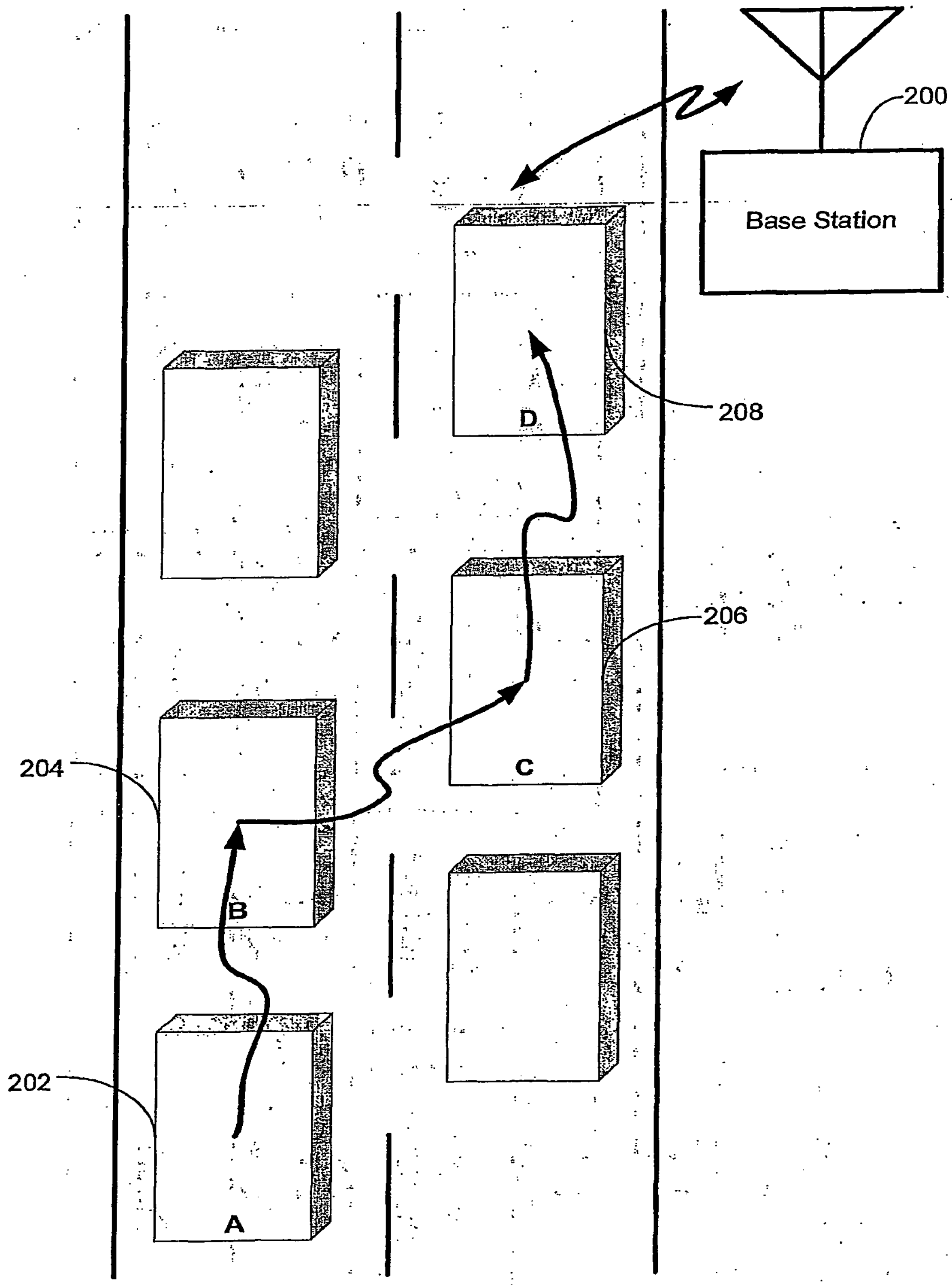

Fig. 2

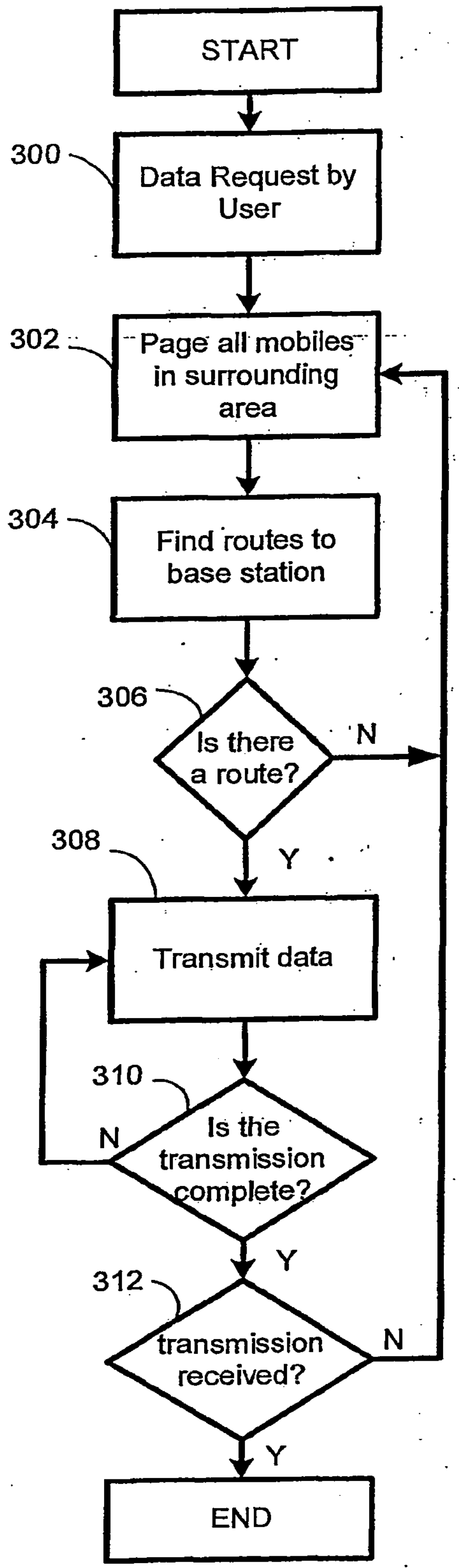
START
300
Data Request by User
302
Page all mobiles in surrounding area
304
Find routes to base station
306
Is there a route?
N
Y
308
Transmit data
310
Is the transmission complete?
N
Y
312
transmission received?
N
Y
END

Fig. 3

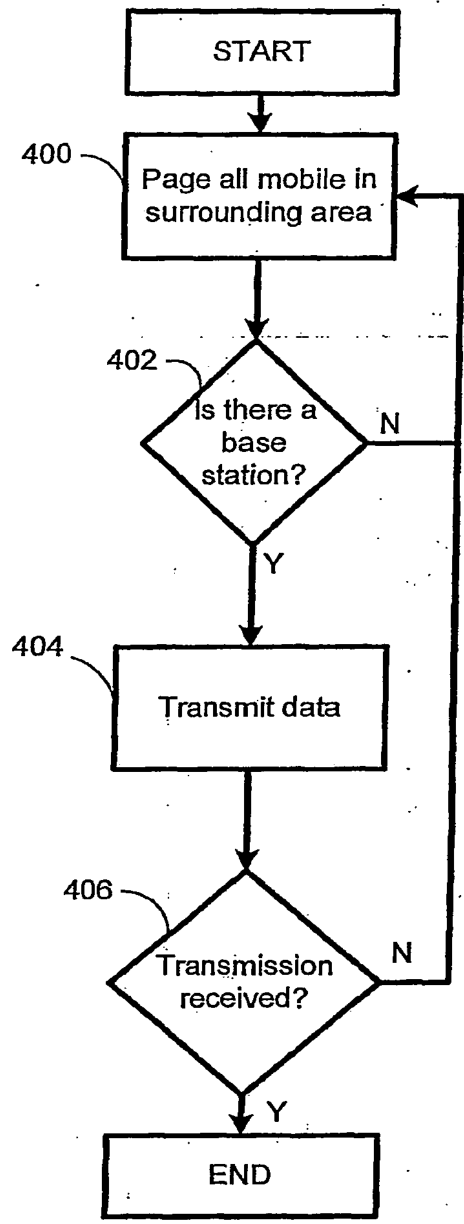
START
400
Page all mobile in surrounding area
402
Is there a base station?
N
Y
404
Transmit data
406
Transmission received?
N
Y
END

Fig. 4

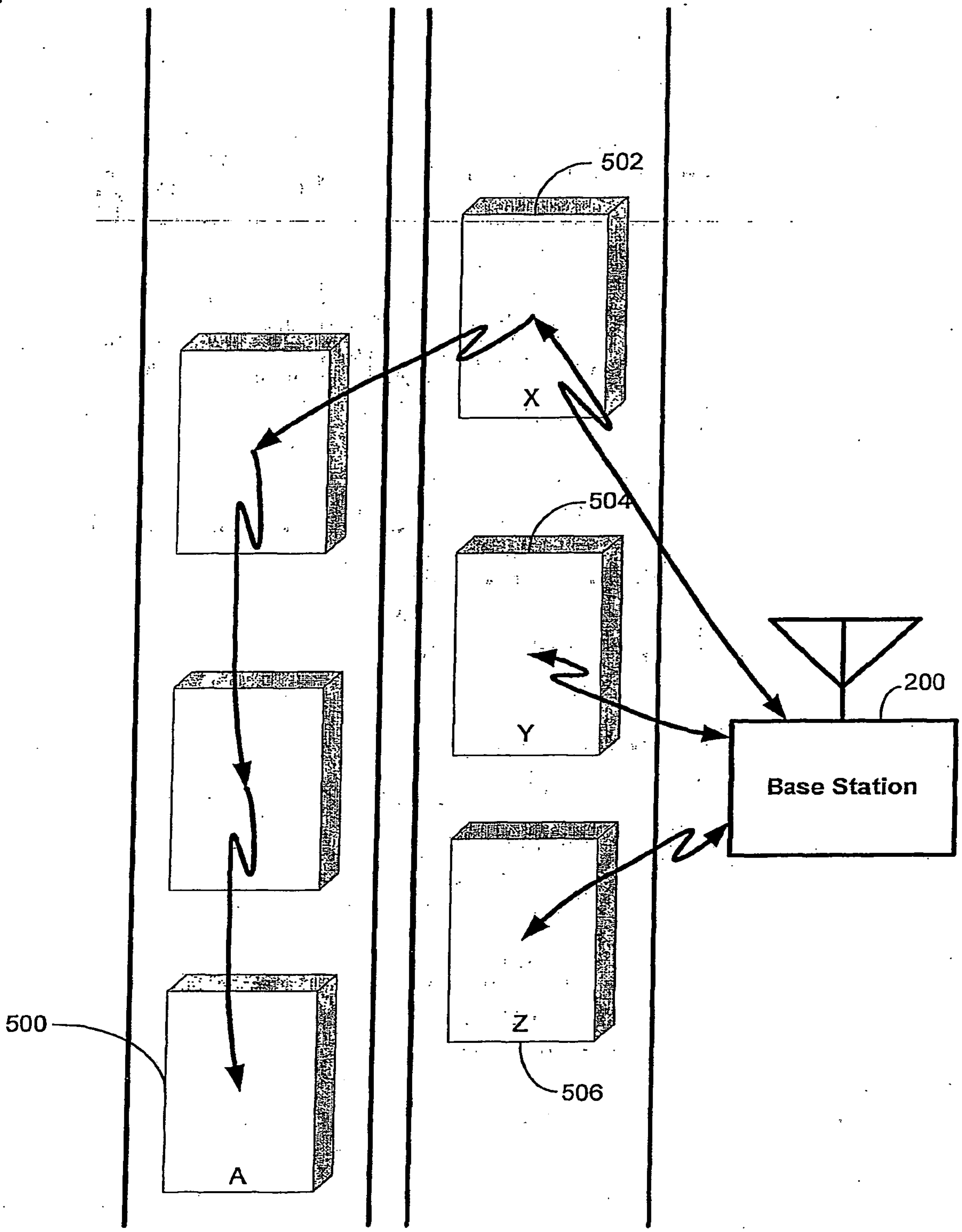

Fig. 5

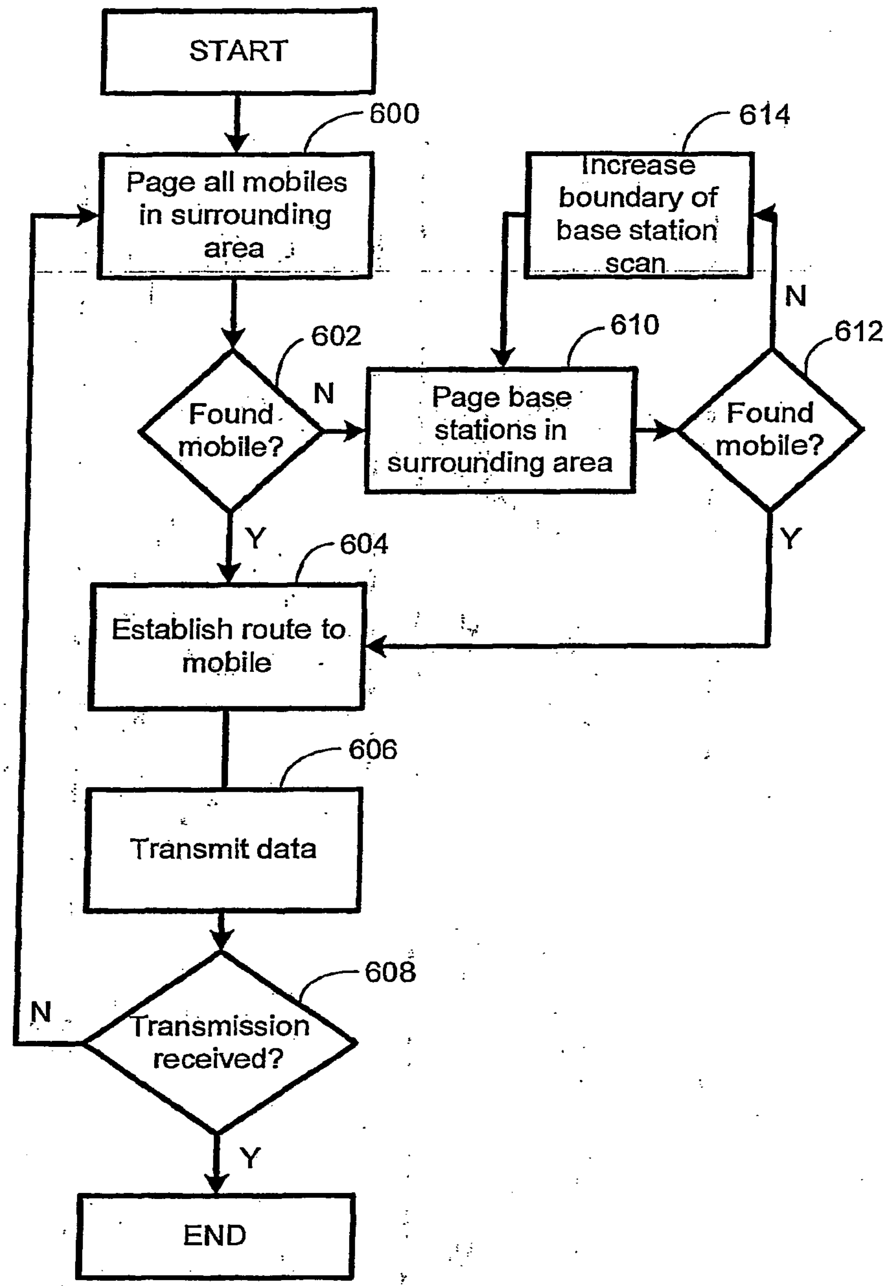
START
600
Page all mobiles in surrounding area
602
Found mobile?
N
Y
604
Establish route to mobile
606
Transmit data
608
Transmission received?
N
Y
END
610
Page base stations in surrounding area
612
Found mobile?
N
Y
614
Increase boundary of base station scan

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US01/29407

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04Q 7/20
US CL :455/403
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/403,412,414,426,440,456,517; 370/238,349,400,401

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,953,319 A (DUTTA et al.) 14 September 1999, col. 2, line 52 - col. 3, line 14	1-22
Y,P	US 6,275,707 B1 (REED et al.) 14 August 2001, col. 1, lines 1-59)	1-22
Y,P	US 6,289,389 B1 (KIKINIS) 11 September 2001, col. 1, line 11 - col. 3, line 23	1-22
A	US 6,323,893 B1 (TOSAYA) 27 November 2001, col. 2, line 42 - col. 5, line 64	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 02 DECEMBER 2001	Date of mailing of the international search report 21 FEB 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer EDWARD F. URBAN Telephone No. (703) 305-4385

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